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(54) **Electrical switches**

(57) A switch comprises a movable contact 25 in the form of a curved plate having an arcuate cross section, and terminals 20a, 20b having ends 21a, 21b projecting into a cavity 24 in an insulating body 22. The movable contact 25 is stressed to cause an end of the contact to be resiliently held against and slidably supported on the ends of the terminals 20a, 20b, electrical connection between which is made and broken by sliding movement of the contact 25.

FIG. 5

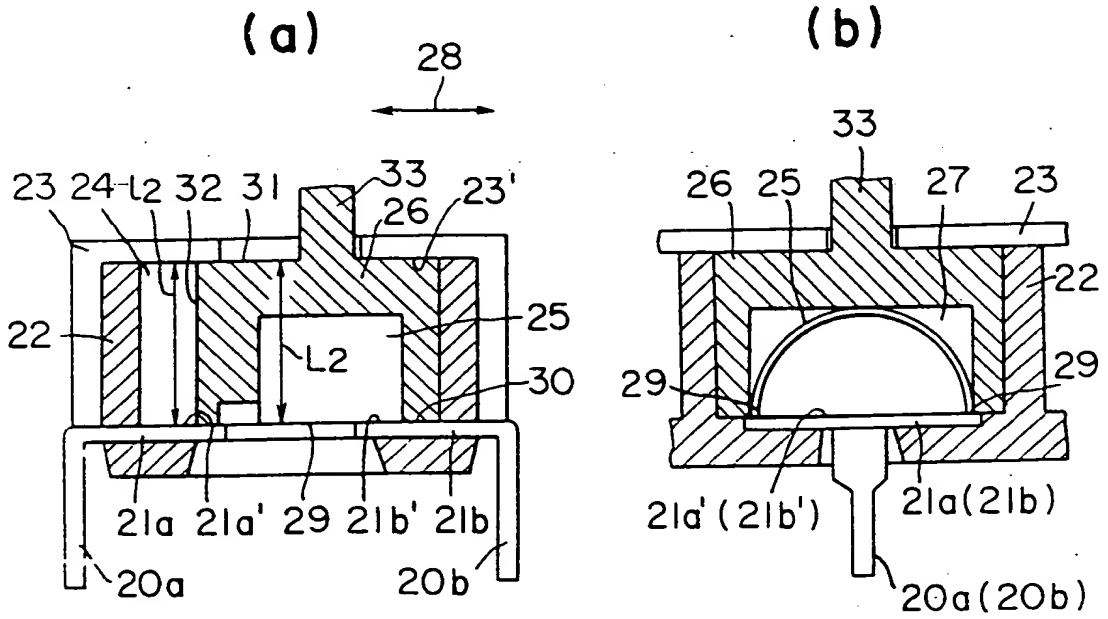


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FIG. 1

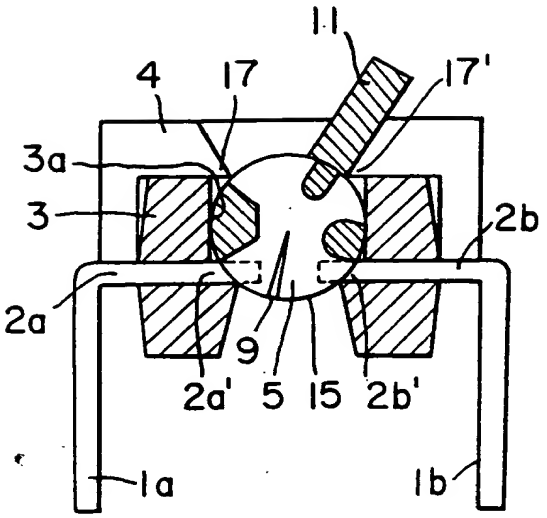



FIG. 2

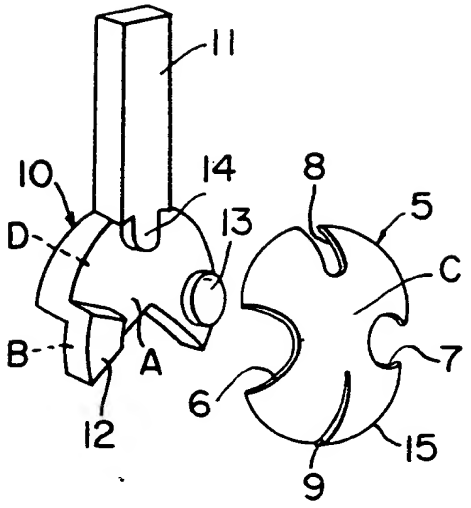



FIG. 3

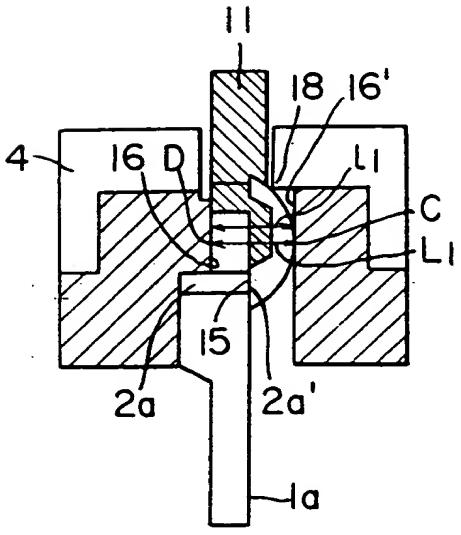
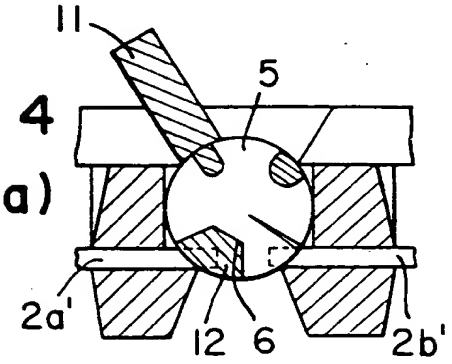



FIG. 4

(a)




(b)

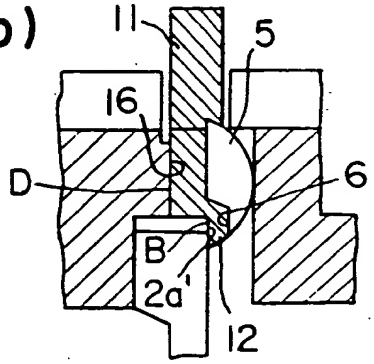


FIG. 5

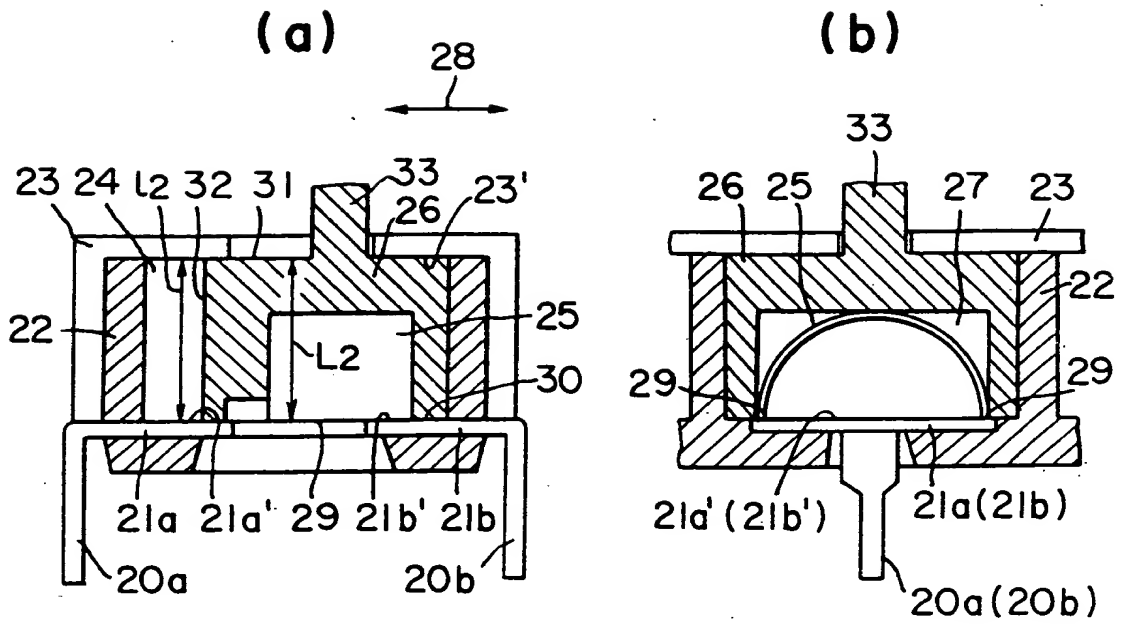

(a)
28
23 24 L2 32 31 33 23'
26
22
25
L2
30
21a 21a' 29 21b' 21b
20a
20b
(b)
33
26 25 27 23
22
29
29
21a' (21b')
21a(21b)
20a(20b)

FIG. 6

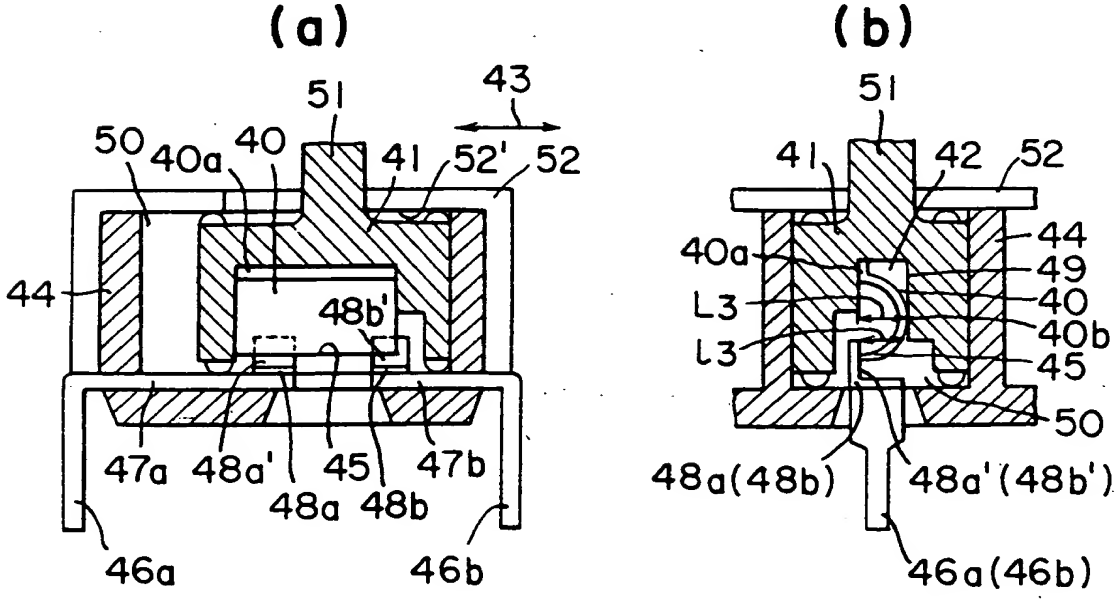
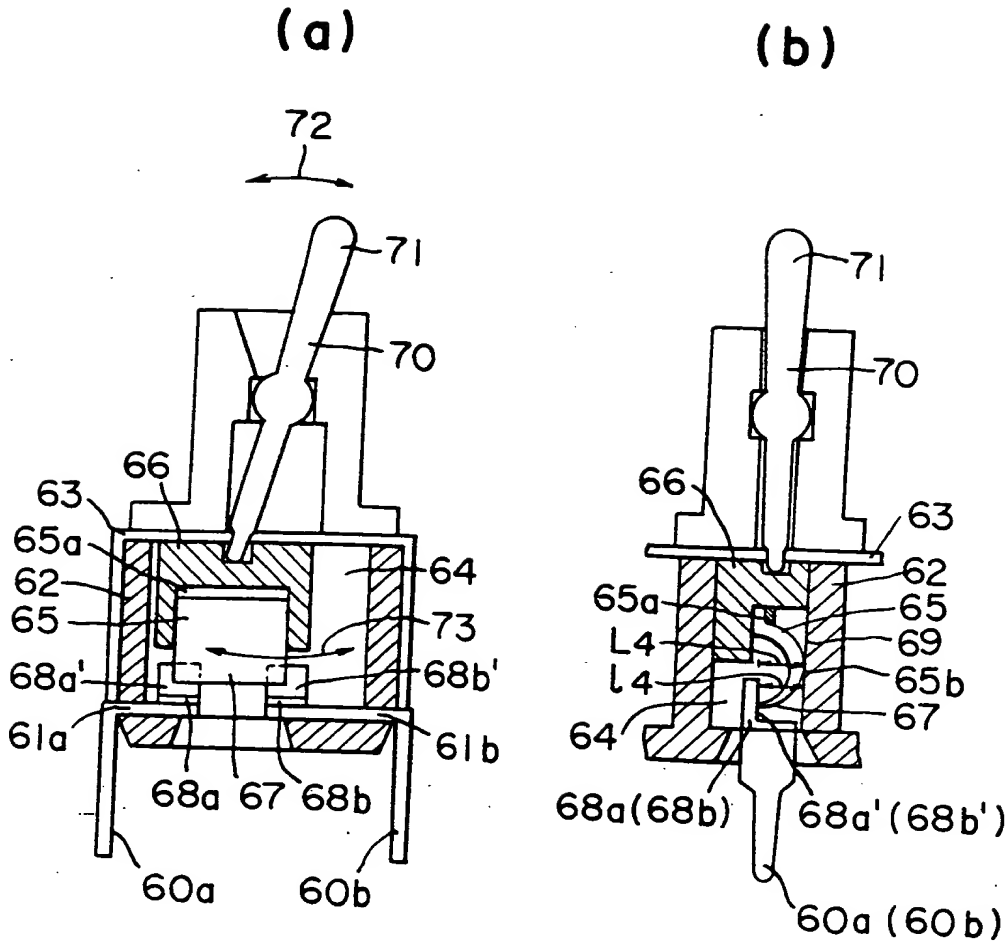

(a)
43
51
50 40a 40 41 52' 52
44
48b'
47a 48a' 45 47b
48a 48b
46a
46b
(b)
51
41 42 52
40a
44
49
L3
40
40b
L3
45
50
48a(48b)
48a'(48b')
46a(46b)

FIG. 7


(a)
(b)
72
71
70
66
63
65a
62
65
64
73
68a'
68b'
61a
61b
68a
67
68b
60a
60b
71
70
66
63
62
65a
65
L4
69
l4
65b
67
64
68a(68b)
68a'(68b')
60a (60b)

SPECIFICATION

# Switch

The present invention relates to a switch, and more particularly to a switch having a movable conductive contact held against the ends of terminals under increased pressure for switching operation.

There are various forms of mechanisms for switching on and off a current in a switch. One known mechanism is of a toggle construction having a conductive contact which is resiliently held against the end of one terminal and movable into contact with the end of the other terminal by a toggle rotatable about an intermediate ball member for making electrical connection between the terminals. The terminals can be electrically disconnected from each other when the contact is disengaged from the end of the other terminal upon release of pressure on the contact. The pressure with which the contact is held against the end of the other terminals is relatively weak with the use of such a toggle.

Another conventional structure is known as a sliding mechanism including a conductive contact which is normally urged downwardly as by a spring and held against one terminal end, the conductive contact being slidable laterally into contact with the other terminal end for electrical connection between the terminal ends. The electrical connection can be broken by sliding the contact out of contact with the other terminal end. The sliding mechanism can press the contact against the other terminal end with a relatively high pressure. However, there are structural limitations which prevent the application of a pressure large enough to sufficiently remove deposits from the contact or the terminal ends while the contact slides frictionally.

In order to prevent deposition of various forms of foreign matter such as dust and flux which could lose electrical conduction, it is necessary to enclose the switch in a shielded structure.

The metal surfaces of the terminal ends and contact tend to form non-conductive films thereon with time due to external environmental conditions, non-conductive films such as natural oxides formed by oxygen in the ambient air. Such non-conductive films can be broken by currents of medium magnitudes flowing through switches, and removed by frictional contact with the contact. However, the deposits cause malfunctions such as non-conduction in switches such as DIP switches which handle small currents on the order of microamperes. To avoid the formation of oxidized layers, vital portions of the terminal ends and contact have heretofore been plated with chemically stable precious metals such as rhodium and gold.

An object of the invention is to provide an improved switch.

According to the present invention there is provided a switch comprising, a body of insulating material, a plurality of contact terminals supported on the body, and a movable conductive contact in the form of a curved plate preloaded so as to have a portion thereof resiliently held against and slidably supported on the contact terminals, electrical connection between the contact terminals being made or broken by sliding movement of the movabls contact relative to the contact terminals.

More particularly, a switch comprises an insulating base having a cavity, terminals supported on the insulating base and having ends projecting into the cavity, and a movable conductive contact in the form of a curved plate having an arcuate cross section, the movable conductive contact being pressed in the cavity and having an end resiliently held against and slidably supported on the ends of the terminals. With the arrangement of the present invention, the contact which is placed in the cavity is held against the terminal ends under pressure due to the shape of the contact itself without relying on any other urging means such as a spring. Thus, the contact is pressed against the terminal ends under increased pressure so as to withstand repeated switching operations. As the contact is held in bitting engagement with the terminal ends, it renews contact surfaces when switching operation is repeated, for thereby reliably switching on and off currents stably for a long period of time. Contacting surfaces of the terminal ends and contact do not need to be plated with precious metal. The switch requires no shielding structure, and can bodily be washed in water. Since the switch is simple in construction, it can be fabricated less costly. The switch can find application to small size switches such as DIP switches handling currents on the order of microamperes.

The invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is a transverse cross-sectional view of a switch according to a first embodiment of the present invention;

Figure 2 is a perspective view of a movable conductive contact and a slide plate on which the contact is mounted, for the switch shown in Figure 1;

Figure 3 is a longitudinal cross-sectional view of the switch illustrated in Figure 1;

Figure 4(a) and 4(b) are transverse and longitudinal cross-sectional views, respectively, showing the positions of the respective parts with the switch turned off;

Figure 5(a) and 5(b) are transverse and longitudinal cross-sectional views, respectively, of a switch according to a second embodiment of the invention;

Figure 6(a) and 6(b) are transverse and longitudinal cross-sectional views, respectively, of a switch according to a third embodiment of the invention; and

Figure 7(a) and 7(b) are transverse and longitudinal cross-sectional views, respectively, of a switch according to a fourth embodiment of the invention.

member 26 are indicated by the arrowheads 28. The contact 25 has ends 29 held in abutment against upper surfaces 21a', 21b' of the ends 21a, 21b of the terminals 20a, 20b.

With the contact 25 mounted in the slide member 26, the ends 29 project beyond a lower end 30 of the slide member 26, and the distance $L_2$ between the ends 29 and an upper end 31 of the slide member 26 is larger than the vertical dimension $l_2$ of the cavity 24. The slide member 26 has a side 32 which is of a vertical length slightly smaller than the dimension $l_2$. When the contact 25 us disposed in the slide member 26 is force-fitted in the cavity 24, the ends 29 of the contact 25 are resiliently pressed against the upper surfaces 21a', 21b' of the terminal ends. When a knob 33 on the slide member 26 is slid in the direction of one of the arrowheads 28 at a time, the slide member 26 is guided by an inner surface 23' of the cover 23 so as to slide over the upper surfaces 21a', 21b' of the terminal ends.

Since the contact 25 is in the form of a resilient arcuate metal plate, the ends 29 thereof are held in biting engagement with the upper surfaces 21a', 21b' for good electrical connection. The ends 29 may be cut into shape of a knife edge for better electrical connection.

Operation of the switch shown in Figs. 5(a) and 5(b) will be described. In Fig. 5(a), the contact 25 is displaced out of contact with the upper surface 21a' of the end of the terminal 20a, the hence the terminals 20a, 20b are electrically disconnected from each other. When the knob 33 is slide to the left to move the contact 25 towards the left the ends 29 of the contact 25 are brought over the upper surface 21a' of the terminal end 21a, whereupon the terminals 20a, 20b are electrically interconnected. With the arrangement shown in Figs. 5(a) and 5(b), the ends 29 of the contact 25 are pressed strongly against the upper surfaces 21a', 21b' under high pressure in biting engagement therewith.

According to a third embodiment shown in Figs. 6(a) and 6(b), a movable conductive contact 40 is formed from a rectangular conductive metal plate into an arcuate structure with an end portion 40a extending rectilinearly. The movable conductive contact 40 is fitted in a recess 42 in a slide member 41. The contact 40 is positioned such that it looks arcuately when viewed in the direction of the arrowheads 43 along which the slide member 41 is slidable or the terminal ends 21a, 21b are spaced from each other, the contact 40 being disposed on an insulating base 44. The contact 40 has an end 45 held in frictional contact with arms 48a', 48b' of L-shaped contact members 48a, 48b mounted on ends 47a, 47b, respectively, of terminals 46a, 46b supported on the insulating base 44. The arms 48a', 48b' extend into a cavity 50 in the insulating base 44.

With the contact 40 mounted in the slide member 41, the distance $L_3$ between an arcuate crest 40b of the contact 40 held against a resin wall 49 of the recess 42 in the slide member 41 and a distal edge of the end 45 of the contact 40 is larger than the distance $l_3$ between the resin wall 49 and the arms 48a', 48b' of the contact members 48a, 48b. Therefore the contact 40 as mounted in the slide member 41 and inserted forcibly between the arms 48a', 48b' projecting into the cavity 50 and the resin wall 49, has its end 45 resiliently held against the arms 48a', 48b'. When a knob 51 on the slide member 41 is slid in the direction of one of the arrowheads 43, the slide member 41 is guided by an inner surface 52' of a cover 52 so as to slide over the arms 48a', 48b'.

Although the contact 40 is shown as being held against the arms 48a', 48b' of the L-shaped contact members 48a, 48b mounted on the terminal ends 47a', 47b', the contact 40 may be held in frictional engagement directly with the terminal ends 47a', 47b' which may be L-shaped in cross section.

In Fig. 6(a), the end 45 of the contact 40 is shown as contacting the arms 48a', 48b' of the contact members 48a, 48b, and the terminals 46a, 46b are electrically connected to each other. When the knob 51 is displaced to slide the contact 40 to the left, the end 45 of the contact 40 is disengaged from one of the arms 48b', whereupon the terminals 46a, 46b are electrically disconnected from each other.

Figs. 7(a) and 7(b) illustrate a switch according to a fourth embodiment of the present invention. The switch of Figs. 7(a) and 7(b) is basically of the same construction as that of the switch shown in Figs. 6(a) and 6(b). The switch has an insulating base 62 supporting terminals 60a, 60b having ends 61a, 61b, a cover 63 fitted over the insulating base 62, and a contact 65 disposed in a cavity 64 defined jointly by the insulating base 62 and the cover 63. The contact 65 is formed from a rectangular conductive metal plate into an arcuate construction with a rectilinear end portion 65a, an arrangement similar to that shown in Figs. 6(a) and 6(b). The contact 65 is mounted on the insulating base 62 such that it looks arcuate when viewed in the direction along a slide member 66 with the contact 65 mounted therein is slidable. The contact 65 has an end 67 held in frictional engagement with projecting arms 68a', 68b' of L-shaped contact member 68a, 68b fixedly mounted on the ends 61a, 61b of the terminals 60a, 60b.

When the contact 65 is mounted in the slide member 66, the distance $L_4$ between an arcuate crest 69 of the contact 65 which is held against a resin wall 69 of the insulating base 62 and a distal edge of the end 67 of the contact 65 is larger than the distance $l_4$ between the resin wall 69 and the arms 68a', 68b'. Therefore, the contact 65 as it is mounted in the slide member 66 and force-fitted between the resin wall 69 of the cavity 64 and the arms 68a', 68b', has its end 65 pressed resiliently against the arms 68a', 68b'. Angular movement of a knob 71 of a toggle lever 70 engaging the slide member 66 in the directions of the arrowheads 72 causes the

contact 65 to slide on the arms 68a', 68b' in the directions of the arrowheads 73.

The end 67 of the contact 65 may be cut into the form of a knife edge for better electrical connection with the arms 68a', 68b'. As with the switch shown in Figs. 6(a) and 6(b), the terminal ends 61a, 61b may be cross-sectionally L-shaped and the contact 65 may be elongated in the longitudinal direction for direct frictional contact with the terminal ends 61a, 61b. Although in the illustrated embodiment the contact 65 is mounted in the slide member 66 and press-fitted between the resin wall 69 of the cavity 64 and the arms 68a', 68b' for easily sliding movement, the slide member 66 may be dispensed with and the contact 65 may directly be inserted between the wall 69 and the arms 68a', 68b'.

In the position of Fig. 7(a), the end 67 of the contact 65 is pressed in frictional contact with the arms 68a', 68b' of the contact members 68a, 68b and the terminals 60a, 60b are electrically connected to each other. When the knob 71 of the lever 70 is angularly moved counter-clockwise, the end 67 of the contact 65 mounted in the slide member 66 is slidably turned counter-clockwise in a plane defined jointly by the arms 68a', 68b' until the end 67 is disengaged from one of the arms 68a', whereupon the terminals 60a, 60n are electrically disconnected from each other.

**Claims**

1. A switch comprising:
an insulating base having a cavity;
a plurality of terminals supported on said insulating base and having end projecting into said cavity; and
a movable conductive contact in the form of a curved plate having an arcuate cross section, said movable conductive contact being pressed in said cavity and having an end resiliently held against and slidably supported on said ends of said terminals, said movable conductive contact being slidably movable for making and breaking electrical conneetion between said terminals.

2. A switch according to claim 1, including a slide member slidably mounted in said insulating base, said end of said movable conductive contact being mounted on said slide member, said movable conductive contact and said slide member being pressed together in said cavity.

3. A switch according to claim 1, wherein said end of said movable conductive contact is in the form of a knife edge.

4. A switch comprising:
an insulating base having a cavity;
a plurality of terminals supported on said insulating base and having ends projecting into said cavity; and
a movable conductive contact in the form of a part spherical plate having a current-breaking recess in a peripheral edge thereof, said movable conductive contact being pressed in said cavity with said peripheral edge being resiliently pressed against sides of said ends of said terminals, said movable conductiv contact being slidably angularly movable to angularly move said peripheral edge in a plane defined jointly by said sides for displacing said current-breaking recess into or out of engagement with one of said sides for breaking or making electrical connection between said terminals.

5. A switch according to claim 4, including a slide plate of resin in the form of a disc having a sectoral notch in a lower side thereof, said movable conductive contact being mounted on said slide plate with said peripheral edge being exposed through said sectoral recess for engagement with said ends of said terminals, said movable conductive contact and said slide plate being pressed together in said cavity.

6. A switch according to claim 4 or 5, wherein said peripheral edge has a slit for adjusting the resilient force with which said peripheral edge is pressed against said ends of said terminals.

7. A switch according to claim 6, wherein said peripheral edge is in the form of a knife edge.

8. A switch comprising:
an insulating base having a cavity;
a plurality of terminals supported on said insulating base and having ends projecting into said cavity; and
a movable conductive contact in the form of a rectangular plate having an arcuate cross section, said movable conductive contact being pressed in said cavity and having an end extending in a direction along which said ends of said terminals are spaced, said end of said movable conductive contact being resiliently held against and slidably supported on said ends of said terminals, said movable conductive contact being slidably movable for making and breaking electrical connection between said terminals.

9. A switch according to claim 8, wherein said end of said movable conductive contact is held against upper surfaces of said end of said terminals.

10. A switch according to claim 9, including a slide member slidable in said direction, said end of said movable conductive contact being mounted on said slide member, said movable conductive contact and said slide member being pressed together in said cavity.

11. A switch according to claim 9 or 10, wherein said end of said movable conductive contact is in the form of a knife edge.

12. A switch according to claim 8, wherein said end of said movable conductive contact is held against sides of said ends of said terminals.

13. A switch according to claim 8, including L-shaped contact members fixedly mounted on said ends of said terminals and spaced from each other in said direction, said contact members having arms extending into said cavity, said end of said movable conductive contact being held against said arms of said L-shaped contact members.

14. A switch according to claim 12 or 13, including a slide member slidable in said direction, said end of said movable conductive

contact being mounted on said slide member, said movable conductive contact and said slide member being pressed together in said cavity.

15. A switch according to claim 12 or 13, including a slide member rotatabl in a plane in which said sides or said arms are disposed, said end of said movable conductive contact being mounted on said slide member, said movable conductive and said slide member being pressed together in said cavity.

16. A switch according to claim 12, 13, 14 or 15, wherein said end of movable conductive contact is in the form of a knife edge.

17. A switch comprising, a body f insulating material, a plurality of contact terminals supported on the body, and a movable conductive contact in the form of a curved plate preloaded so as to have a portion thereof resiliently held against and slidably supp rted on th contact terminals, electrical connection b tween the contact terminals being made or broken by sliding movement of the movable contact relative to the contact terminals.

18. A switch substantially as hereinbefore described with reference to and as illustrated in Figures 1 to 4, 5, 6, and 7.

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